REMARKS

The application has been amended and is believed to be in condition for allowance.

Claims 1, 5, 6, and 8-11 were rejected as anticipated by RU 2137933.

Applicant acknowledges with appreciation the indication that claims 2-4 and 7 are directed to allowable subject matter.

The claims have been amended and new claims added. No new matter is entered by way of these amendments.

Claims 1, 5 and 6

To overcome the anticipation rejection to these claims, the aspects of original claim 2 have been introduced into claim 1.

To distinguish the present invention from that described in RU 2137933, the claims of the present invention now include the feature of the "crankshaft-less" output drive system. This is the feature generally described in original claim 2. The feature describes how the reciprocating motion of the sleeve is converted into rotary motion as it acts against a cam profile on a rotatable output member.

Such an output drive system is not anticipated in RU 2137933 and it is believed by the applicant to be new and inventive, and to be a significant advantage compared to a crankshaft style output drive system. The advantages of a

"crankshaft-less" output drive system are recited in the patent specification.

In addition, the term "*end cam*" is used in the main claim to describe the cam profile or curved track on the rotatable output member for improved clarity. A review of technical terminology has confirmed that the term "*end cam*" is the accepted technical term for such a cam or track profile on the end of a cylinder – please refer to the **attached** definitions provided by the Britannica Online Encyclopedia, the Carnegie Mellon University, and by Roy Beardmore on www.roymech.co.uk.

By way of a clarification, it is also requested that the term "*end cam*" be added to page 8 of the specification. To avoid confusion, specification page 8 has been amended.

Claim 2

Amend claim 2 recites the "end cam" as a track on the rotatable output member, primarily to link the new term to the language used in the original patent description.

Claim 4

Amended claim 4 now provides the wording "the end cam of the rotatable output member has multiple peaks" for improved clarity.

Claims 8 and 9

Also, to improve the clarity of original claim 8, this claim has been amended and is now presented as an independent

claim. The amended claim 8 also includes the features of claim 2 to overcome the anticipation rejection.

Claim 9 is cancelled.

Claim 10

The term "*when the engine is in use*" is added for improved clarity.

Claims 12 and 13

New independent claim 12 and dependent claim 13 also recite the invention. The limitation of the crankshaft-less output drive system distinguishes the present invention from the prior art.

In view of the above amendments, the claims are believed both novel and non-obvious. Allowance of all the claims is solicited.

This amendment is believed to be fully responsive and to put the case in condition for allowance. Entry of the amendment, and an early and favorable action on the merits, are earnestly requested. Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Should there be any matters that need to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned at the telephone number listed below.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any

overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON

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REL/lrs

APPENDIX:

The Appendix includes the following items:

- www.roymech.co.uk printout
- Britannica Online Encyclopedia extract
- Carnegie Mellon University extract

Home
Machine_Parts_Index

Cam Design

More details on Cam design are to be found in the links below the table

INTRODUCTION

A Cam is a machine component that either rotates or moves back and forth (reciprocates) to create a prescribed motion in a contacting element known as a follower. The shape of the contacting surface of the cam is determined by the prescribed motion and the profile of the follower.

Cam-follower mechanisms are particularly useful when a simple motion of one part of a machine is to be converted to a more complicated prescribed motion of another part, one that must be accurately timed with respect to the simple motion and may include periods of rest (dwells). Cams are essential elements in automatic machine tools, textile machinery, sewing machines, printing machines, and many others. If the follower is not restrained by a groove on the cam, a spring is necessary to keep the follower in contact with the cam.

Cam systems can replace relatively complicated linkages in achieving desirable motion cycles.

In all cam systems it is important that the follower is always in contact and following the motion of the cam. This is achieved in a number of ways including the following.

- Gravity
- Using a mechanical constraint system i.e groove
- Using a spring force
- Using a pneumatic or hydraulic force

Cams are made in a variety of forms,including:

- A rotating disk or plate with the radial required profile;
- A reciprocating wedge of the required shape.
- A cylindrical barrel cam with a follower groove cut in the diameter
- A cylinder with the required profile cut in the end (end cam);

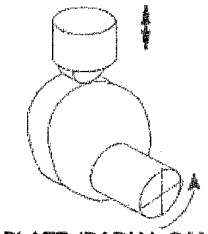
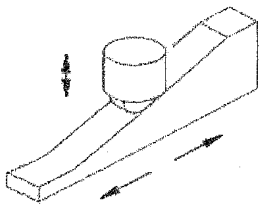
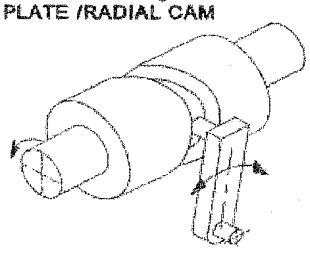


PLATE /RADIAL CAM



WEDGE CAM



BARREL CAM

END/FACE

Cam followers

Cams followers can be either reciprocating or pivoting. There are various methods of transferring the motion from the cam to the follower including the following:

- Knife Edge
- Flat-face
- Roller

- A Tradition of CAD/CAM and Competition.
  Tech Directions, January 2007
- And the survey says ... Americans and CAMs.
  Pharmacy Today, February 2009
- CAD/CAM.
  Tech Directions, May 2007
- Crow Cams Spy on Wild Birds.
  Current Science, January 4, 2008
- GEN III MECHANICAL ROLLER CAMS.
  Hot Rod, November 2008

There is no media currently available for this topic

end cam

machine component

Main

Aspects of the topic end-cam are discussed in the following places at Britannica.

Assorted References

- **description** (*in* **cam (machine component)**)

  ...on its face to fit a roller on the follower (face cam); (3) a cylindrical or conical member with a follower groove cut around the surface; (4) a cylinder with the required profile cut in the end (end cam); (5) a reciprocating wedge of the required shape.

Introduction to Mechanisms

(See PAGE 3 *)

Yi Zhang
with
Susan Finger
Stephannie Behrens

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6 Cams

6.1 Introduction

6.1.1 A Simple Experiment: What is a Cam?

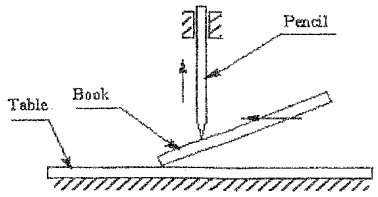

Figure 6-1 Simple Cam experiment

Take a pencil and a book to do an experiment as shown above. Make the book an inclined plane and use the pencil as a slider (use your hand as a guide). When you move the book smoothly upward, what happens to the pencil? It will be pushed up along the guide. By this method, you have transformed one motion into another motion by a very simple device. This is the basic idea of a cam. By rotating the cams in the figure below, the bars will have either translational or oscillatory motion.

6.1.2 Cam Mechanisms

The transformation of one of the simple motions, such as rotation, into any other motions is often conveniently accomplished by means of a **cam mechanism** A cam mechanism usually consists of two moving elements, the cam and the follower, mounted on a fixed frame. Cam devices are versatile, and almost any arbitrarily-specified motion can be obtained. In some instances, they offer the simplest and most compact way to transform motions.

A ***cam*** may be defined as a machine element having a curved outline or a curved groove, which, by its oscillation or rotation motion, gives a predetermined specified motion to another element called the ***follower*** . The cam has a very important function in the operation of many classes of machines, especially those of the automatic type, such as printing presses, shoe machinery, textile machinery, gear-cutting machines, and screw machines. In any class of machinery in which automatic control and accurate timing are paramount, the cam is an indispensable part of mechanism. The possible applications of cams are unlimited, and their shapes occur in great variety. Some of the most common forms will be considered in this chapter.

6.2 Classification of Cam Mechanisms

We can classify cam mechanisms by the modes of input/output motion, the configuration and arrangement of the follower, and the shape of the cam. We can also classify cams by the different types of motion events of the follower and by means of a great variety of the motion characteristics of the cam profile. (Chen 82)

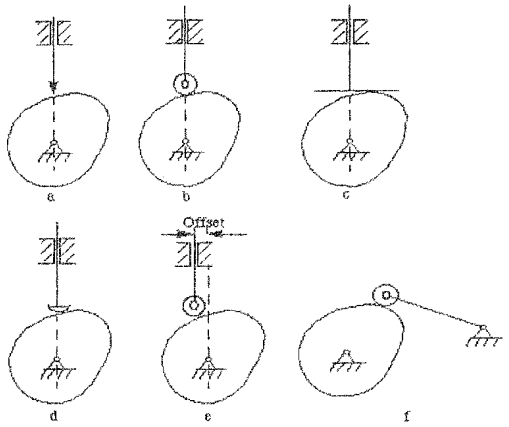

Figure 6-2 Classification of cam mechanisms

4.2.1 Modes of Input/Output Motion

1. Rotating cam-translating follower. (Figure 6-2a,b,c,d,e)
2. Rotating follower (Figure 6-2f):
   The follower arm swings or oscillates in a circular arc with respect to the follower pivot.
3. Translating cam-translating follower (Figure 6-3).
4. Stationary cam-rotating follower:
   The follower system revolves with respect to the center line of the vertical shaft.

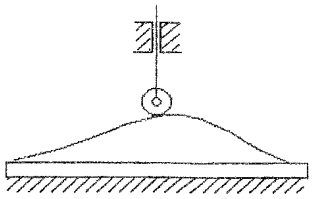

Figure 6-3 Translating cam - translating follower

6.2.1 Follower Configuration

1. **Knife-edge follower** (Figure 6-2a)
2. **Roller follower** (Figure 6-2b,e,f)
3. **Flat-faced follower** (Figure 6-2c)
4. **Oblique flat-faced follower**
5. **Spherical-faced follower** (Figure 6-2d)

6.2.2 Follower Arrangement

1. In-line follower:
   The center line of the follower passes through the center line of the camshaft.
2. Offset follower:
   The center line of the follower does not pass through the center line of the cam shaft. The amount of **offset** is the distance between these two center lines. The offset causes a reduction of the side thrust present in the roller follower.

6.2.3 Cam Shape

1. Plate cam or **disk cam**:
   The follower moves in a plane perpendicular to the axis of rotation of the camshaft. A translating or a swing arm follower must be constrained to maintain contact with the cam profile.
2. **Grooved cam** or closed cam (Figure 6-4):
   This is a plate cam with the follower riding in a groove in the face of the cam.

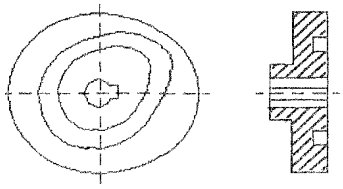

Figure 6-4 Grooved cam

3. **Cylindrical cam** or barrel cam (Figure 6-5a):
   The roller follower operates in a groove cut on the periphery of a cylinder. The follower may translate or oscillate. If the cylindrical surface is replaced by a conical one, a conical cam results.
4. **End cam** (Figure 6-5b):
   This cam has a rotating portion of a cylinder. The follower translates or oscillates, whereas the cam usually rotates. The end cam is rarely used because of the cost and the difficulty in cutting its contour.

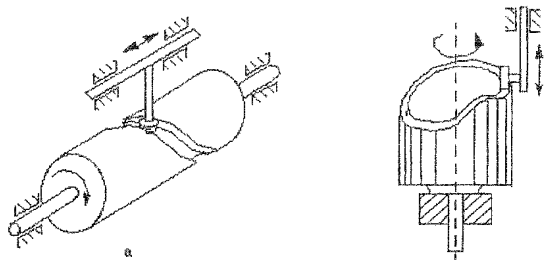

Figure 6-5 Cylindrical cam and end cam

6.2.4 Constraints on the Follower

1. Gravity constraint:
   The weight of the follower system is sufficient to maintain contact.
2. Spring constraint:
   The spring must be properly designed to maintain contact.
3. Positive mechanical constraint:
   A groove maintains positive action. (Figure 6-4 and Figure 6-5a) For the cam in Figure 6-6, the follower has two rollers, separated by a fixed distance, which act as the constraint; the mating cam in such an arrangement is often called a *constant-diameter cam*.

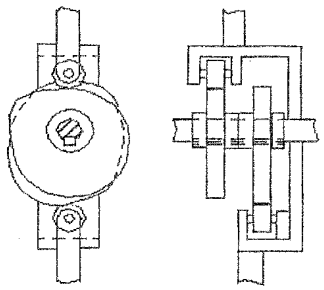

Figure 6-6 Constant diameter cam

A mechanical constraint cam also be introduced by employing a dual or conjugate cam in arrangement similar to what shown in Figure 6-7. Each cam has its own roller, but the rollers are mounted on the same reciprocating or oscillating follower.